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## **Ridge preservation techniques for implant therapy.**

Darby I, Chen ST, Buser D.

Int J Oral Maxillofac Implants. 2009;24 Suppl:260-71.

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### **Abstract**

**PURPOSE:** The aim of this review was to evaluate the techniques and outcomes of postextraction ridge preservation and the efficacy of these procedures in relation to subsequent implant placement.

**MATERIALS AND METHODS:** A MEDLINE/PubMed search was conducted and the bibliographies of reviews from 1999 to March 2008 were assessed for appropriate studies. Randomized clinical trials, controlled clinical trials, and prospective/retrospective studies with a minimum of five patients were included.

**RESULTS:** A total of 135 abstracts were identified, from which 53 full-text articles were further examined, leading to 37 human studies that fulfilled the search criteria. Many different techniques, methodologies, durations, and materials were presented in the publications reviewed, making direct comparison difficult.

**CONCLUSIONS:** Despite the heterogeneity of the studies, it was concluded that ridge preservation procedures are effective in limiting horizontal and vertical ridge alterations in postextraction sites. There is no evidence to support the superiority of one technique over another. There is also no conclusive evidence that ridge preservation procedures improve the ability to place implants.

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## Healing of human extraction sockets filled with Bio-Oss.

Carmagnola D, Adriaens P, Berglundh T.

Clin Oral Implants Res. 2003 Apr;14(2):137-43.

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### Abstract

The aim of this study was to investigate the healing of human extraction sockets filled with Bio-Oss particles (Geistlich Pharma AG, Wolhusen, Switzerland). In 21 subjects, providing a total of 31 healing sites, at least one tooth was scheduled for extraction and the extraction sites for implant therapy. The dimensions of the alveolar ridge at the extraction sites were considered insufficient and required augmentation concomitant with tooth extraction. There were three treatment groups. In group A, the extraction sockets were covered with a Bio-Gide membrane (Geistlich Pharma AG) and in group B the extraction sockets were filled with Bio-Oss. The extraction sockets in group C were left to heal spontaneously. Biopsies from the extraction sites were collected at the time of implant installation. Samples from group A showed large amounts of lamellar bone and bone marrow and small proportions of woven bone. Sites grafted with Bio-Oss (group B) were comprised of connective tissue and small amounts of newly formed bone surrounding the graft particles. Only 40% of the circumference of the Bio-Oss particles was in contact with woven bone. Sites from group C were characterized by the presence of mineralized bone and bone marrow.

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## Randomized study evaluating recombinant human bone morphogenetic protein-2 for extraction socket augmentation.

Fiorellini JP, Howell TH, Cochran D, Malmquist J, Lilly LC, Spagnoli D, Toljanic J, Jones A, Nevins M.

J Periodontol. 2005 Apr;76(4):605-13.

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### Abstract

**BACKGROUND:** Conventional dentoalveolar osseous reconstruction often involves the use of grafting materials with or without barrier membranes. The purpose of this study was to evaluate the efficacy of bone induction for the placement of dental implants by two concentrations of recombinant human bone morphogenetic protein-2 (rhBMP-2) delivered on a bioabsorbable collagen sponge (ACS) compared to placebo (ACS alone) and no treatment in a human buccal wall defect model following tooth extraction.

**METHODS:** Eighty patients requiring local alveolar ridge augmentation for buccal wall defects (> or =50% buccal bone loss of the extraction socket) of the maxillary teeth (bicuspid forward) immediately following tooth extraction were enrolled. Two sequential cohorts of 40 patients each were randomized in a double-masked manner to receive 0.75

mg/ml or 1.50 mg/ml rhBMP-2/ACS, placebo (ACS alone), or no treatment in a 2:1:1 ratio. Efficacy was assessed by evaluating the amount of bone induction, the adequacy of the alveolar bone volume to support an endosseous dental implant, and the need for a secondary augmentation.

**RESULTS:** Assessment of the alveolar bone indicated that patients treated with 1.50 mg/ml rhBMP-2/ACS had significantly greater bone augmentation compared to controls ( $P < 0.05$ ). The adequacy of bone for the placement of a dental implant was approximately twice as great in the rhBMP-2/ACS groups compared to no treatment or placebo. In addition, bone density and histology revealed no differences between newly induced and native bone.

**CONCLUSION:** The data from this randomized, masked, placebo-controlled multicenter clinical study demonstrated that the novel combination of rhBMP-2 and a commonly utilized collagen sponge had a striking effect on de novo osseous formation for the placement of dental implants.

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### **Strategies for management of single-tooth extraction sites in aesthetic implant therapy.**

Sclar AG.

J Oral Maxillofac Surg. 2004 Sep;62(9 Suppl 2):90-105.

Center for Excellence in Dental Implant Surgery, Miami, FL, USA.

Erratum in:

- J Oral Maxillofac Surg. 2005 Jan;63(1):158.

### **Abstract**

Achieving predictable aesthetic outcomes following the planned removal of a natural tooth suffering from structural, endodontic, or periodontal compromise depends on a multitude of factors that, once identified, guide the implant team in selecting the surgical and prosthetic treatment options best suited for the individual clinical scenario. This article presents pertinent information regarding systematic patient evaluation and special treatment planning considerations for patients facing the loss of a single tooth in an area of high aesthetic importance. The rationale for and details of performing the Bio-Col site preservation technique at the time of tooth removal; guidelines for immediate versus delayed implant placement; selection and sequencing of site-development procedures according to the types of alveolar ridge defects encountered following tooth removal despite the use of site preservation; and a description of prosthetic techniques necessary for the successful management of single-tooth extraction sites in areas of aesthetic concern also are reviewed.

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## **Treatment of the single tooth extraction site.**

Block MS.

Oral Maxillofac Surg Clin North Am. 2004 Feb;16(1):41-63, vi.

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### **Abstract**

This article reviews the normal sequence of events following tooth extraction, with an emphasis on the normal loss of labial/facial bone that results in lack of ideal bone width and height for an ideal single tooth implant-retained restoration. Interceptive strategies involving immediate grafting the extraction site are described. The different treatments planned for single rooted and multirooted tooth sites are reviewed and immediate implant placement and restoration treatments are presented. The material presented is evidence-based on objective evaluation of several single tooth studies currently in followup stages.

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## **Comparison of procedures for immediate reconstruction of large osseous defects resulting from removal of a single tooth to prepare for insertion of an endosseous implant after healing.**

Raghoobar GM, Slater JJ, Hartog L, Meijer HJ, Vissink A.

Int J Oral Maxillofac Surg. 2009 Jul;38(7):736-43. Epub 2009 Apr 7.

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### **Abstract**

This study evaluated the treatment outcome of immediate reconstruction of 45 large osseous defects resulting from removal of a single tooth with a 1:2 mixture of Bio-Oss and autologous tuberosity bone, and three different procedures for soft tissue closing (Bio-Gide membrane, connective tissue graft, full-thickness palatal mucosa graft; n=15 per group). All defects had an unfavourable osseous-gingival relationship and vertical bone loss of >5mm. The hard and soft tissues were immediately reconstructed after removal of the tooth. Implants were inserted after 3 months. Patients' acceptance, complications and postoperative morbidity were prospectively evaluated by standardized clinical and radiographic examinations up to 12 months after the augmentation procedure. The patients completed a questionnaire on subjective complaints related to the procedure. All hard-soft tissue procedures resulted in sufficient bone volume for the insertion of implants and a favourable aesthetic outcome. The gingival mid-buccal aesthetics before, and 1 year after, treatment significantly favoured the full-thickness palatal mucosa graft, showing a gain in gingival contour of 0.5+/-0.8mm; the other procedures resulted in a 1.2+/-1.6mm decrease. Of the procedures evaluated, a full-thickness palatal mucosa graft was the most predictable for immediate reconstruction of the socket after tooth removal.

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## **The influence of Bio-Oss Collagen on healing of an extraction socket: an experimental study in the dog.**

Araújo M, Linder E, Wennström J, Lindhe J.

Int J Periodontics Restorative Dent. 2008 Apr;28(2):123-35.

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### **Abstract**

The objective of the present experiment was to evaluate the effect on hard tissue modeling and remodeling of the placement of a xenograft in fresh extraction sockets in dogs. Five mongrel dogs were used. Two mandibular premolars (4P4) were hemisected in each dog, and the distal roots were carefully removed. In one socket, a graft consisting of Bio-Oss Collagen (Geistlich) was placed, whereas the contralateral site was left without grafting. After 3 months of healing, the dogs were euthanized and biopsies sampled. From each experimental site, four ground sections (two from the mesial root and two from the healed socket) were prepared, stained, and examined under the microscope. The presence of Bio-Oss Collagen failed to inhibit the processes of modeling and remodeling that took place in the socket walls following tooth extraction. However, it apparently promoted de novo hard tissue formation, particularly in the cortical region of the extraction site. Thus, the dimension of the hard tissue was maintained and the profile of the ridge was better preserved. The placement of a biomaterial in an extraction socket may promote bone modeling and compensate, at least temporarily, for marginal ridge contraction.

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### **Alveolar-Ridge-Preservation – Eine Literaturübersicht**

Buch RSR, Wagner W, Reichert TE.

Z Zahnärztl Implantol. 2005 Jan;21(1):30-7.

#### **Zusammenfassung:**

Der nach Zahnverlust regelmäßig resultierende lokale Alveolarkammdefekt stellt auch heute noch eine große chirurgische und prothetische Herausforderung dar. Mit der post extractionem auftretenden Atrophie des Alveolarknochens verschlechtern sich neben dem ästhetischen Erscheinungsbild vor allem die Voraussetzungen für konservative prothetische oder implantologische Versorgungen. Zusätzlich kommt es bei traumatischen Zahnverlusten im Bereich der Oberkieferfront durch traumatische oder resorptive Vorgänge häufig zu einem Verlust der vestibulären Alveolarkompakta mit Beschleunigung der atrophischen Veränderungen.

Aufgrund dieser Probleme wurden schon früh Methoden entwickelt, die alveolären Strukturen nach Zahnverlust zu erhalten. Zur Evaluation der Frage, wie nach Zahnextraktionen oder traumatischem Zahnverlust der zu erwartende Knochendefekt verhindert und eine suffiziente Schleimhautabdeckung mit günstiger Alveolarkammform erreicht werden kann, wurde das Auffüllen frischer Extraktionsalveolen mit unterschiedlichen Materialien in multiplen Studien untersucht. Diese Arbeit gibt eine Zusammenstellung über die bisher publizierten Arbeiten zur Alveolar-Ridge-Preservation und stellt zudem eigene Erfahrungen mit unterschiedlichen

Methoden dar.

Die bisher vorliegenden Ergebnisse geben Anlass für eine optimistische Einschätzung der Alveolarkammprävention. Weitere klinische Studien müssen zur Bestätigung der Effektivität der unterschiedlichen Verfahren folgen.

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## **Sofortrekonstruktion und verzögerte Sofortrekonstruktion der Extraktionsalveole**

Terheyden, Hendrik

Implantologie 14 (2006), Nr. 4, Seite 365-375

### **Abstract**

Ein günstiger Zeitpunkt zum Wiederaufbau von Hart- und Weichgewebe bei Defekten der Extraktionsalveole besteht unmittelbar nach der Zahnextraktion. Kleine Wanddefekte können nach minimalinvasiver intraalveolärer Zahnentfernung transalveolär mit partikulären Knochentransplantaten versorgt werden. Diese Methode erfordert einen Weichgewebeverschluss der Alveole, beispielsweise durch ein gestanztes freies Gingivatransplantat oder ein Zahnreplantat. Bei mehrwandigen Defekten sind ein offener Wandaufbau mit Knochenblocktransplantaten und ein plastischer Weichteilverschluss notwendig. Die Alternative bei mehrwandigen Defekten ist, zunächst einen Weichteilverschluss durch ein freies Bindegewebe-, ein Gingiva- oder ein Kombinationstransplantat zu erzielen und danach die Knochenrekonstruktion verzögert mit geschlossener Weichteildecke durchzuführen. Das Ziel der Sofort- oder der verzögerten Sofortrekonstruktion von Alveolendefekten besteht in der Prävention der Involution oder des Kollapses der Alveole. Die marginalen parodontalen Gewebe des Zahns sollen ohne Verluste durch das Stadium der Implantatheilung hindurch für die spätere implantatgetragene Restauration erhalten werden.

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## **Crestal bone-level changes around implants placed in post-extraction sockets augmented with demineralized freeze-dried bone allograft: a retrospective radiographic study.**

Koutouzis T, Lundgren T.

J Periodontol. 2010 Oct;81(10):1441-8.

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### **Abstract**

**BACKGROUND:** There is limited information regarding marginal crestal bone-level changes around implants placed in post-extraction sockets augmented with demineralized freeze-dried bone allograft (DFDBA). The aim of this study was to retrospectively compare bone-level changes around implants placed in post-extraction sockets augmented with DFDBA to implants placed in native bone.

**METHODS:** Records of 30 consecutive patients treated with dental implants placed in post-extraction sockets augmented with DFDBA and 30 consecutive patients with implants placed in native bone were reviewed. For each implant, the radiographs from the surgical appointment were compared to those from the last follow-up visit and evaluated regarding changes of marginal bone level over time.

**RESULTS:** The overall survival rate from baseline to the last follow-up visit was 100% for both groups. The mean marginal bone loss was 0.15 mm for both groups for a mean follow-up time of 12 months. There were no significant differences regarding the percentage of implants and implant surfaces demonstrating marginal bone loss.

**CONCLUSION:** The present study indicates implants placed in post-extraction sockets augmented with DFDBA exhibited minimal marginal bone loss similar to implants placed in native bone.

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### Modeling and remodeling of human extraction sockets.

Trombelli L, Farina R, Marzola A, Bozzi L, Liljenberg B, Lindhe J.

J Clin Periodontol. 2008 Jul;35(7):630-9. Epub 2008 May 21.

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#### Abstract

**INTRODUCTION:** The available studies on extraction wound repair in humans are affected by significant limitations and have failed to evaluate tissue alterations occurring in all compartments of the hard tissue defect.

**AIM:** To monitor during a 6-month period the healing of human extraction sockets and include a semi-quantitative analysis of tissues and cell populations involved in various stages of the processes of modeling/remodeling.

**MATERIAL AND METHODS:** Twenty-seven biopsies, representative of the early (2-4 weeks, n=10), intermediate (6-8 weeks, n=6), and late phase (12-24 weeks, n=11) of healing, were collected and analysed.

**RESULTS:** Granulation tissue that was present in comparatively large amounts in the early healing phase of socket healing, was in the interval between the early and intermediate observation phase replaced with provisional matrix and woven bone. The density of vascular structures and macrophages slowly decreased from 2 to 4 weeks over time. The presence of osteoblasts peaked at 6-8 weeks and remained almost stable thereafter; a small number of osteoclasts were present in a few specimens at each observation interval.

**CONCLUSIONS:** The present findings demonstrated that great variability exists in man with respect to hard tissue formation within extraction sockets. Thus, whereas a provisional connective tissue consistently forms within the first weeks of healing, the interval during which mineralized bone is laid down is much less predictable.